

NAME: \_\_\_\_\_

## Car Darts and Parabolas

You are working as a stunt coordinator for a TV Show called “Top Gear”. One of the episodes involves a game of “car darts” where driverless cars are launched over a cliff using a nitrogen canon and ramp. Before setting up the stunt, you want to simulate the situation and model the situation mathematically in the computer...

A car will be launched at a 40 degree angle at a speed of 20 m/second over a cliff which is 15 meters tall.

## PART 1.

- A. Sketch a picture of the situation.
- B. Run a simulation of the situation using <https://phet.colorado.edu/en/simulation/projectile-motion>

## PART 2.

- A. Collect data points (time, height) from the simulation that will be helpful in determining a quadratic regression.
- B. Model the path of the launched car as a quadratic function identified as  $f(t)$  where  $t$  represents time and  $f(t)$  represents height.
- C. Graph  $f(t)$  using a graphing calculator.  
Identify the  $X_{min}$ ,  $X_{scl}$ ,  $Y_{min}$ ,  $Y_{scl}$
- D. At what time, will the car reach its highest point?
- E. At what time, will the car hit the ground?
- F. Using 2 of 3 methods, determine the height of the car after 3 seconds of being launched?  
Method 1: Algebraically                      Method 2: Graphically                      Method 3: Simulator

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## PART 3

- A. Collect data points that will be helpful in determining a quadratic regression, written as a function, identified as  $h(x)$ , where  $x$  represents horizontal distance and  $h(x)$  represents vertical distance.
- B. Write the function identified as  $h(x)$ , for the path of the car launched from the top of the cliff.
- B. Graph  $h(x)$  using a graphing calculator.  
Identify the  $X_{min}$ ,  $X_{scl}$ ,  $Y_{min}$ ,  $Y_{scl}$
- C. How high does the car reach?
- D. How high above the cliff does the car reach?
- E. How far will the car travel?
- F. A target is painted on the ground, 40 meters from the base of the cliff. How far from the target does the simulated car land?
- G. What change(s) could be made to the stunt set up so that the car will land on the desired target?